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Operating Manual

DS1C/DS2
DATA INTERFACE
(MODEL 30447A)
OPERATING MANUAL

TTC™
A Dynatech Company

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Rev. A

DS1C/DS2
DATA INTERFACE
(MODEL 30447A)
OPERATING MANUAL

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GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains information on Telecommunications Techniques Corporation's (TTC) DS1C/DS2 Data Interface (Model 30447A). Information on this data interface is divided into sections on: general information; interface description, installation, and set-up; mainframe set-up; interface specifications; and service information.

The DS1C/DS2 Data Interface allows the FIREBERD mainframe to test communications equipment and systems that meet Bell System DSX-1C and DSX-2 type signal specifications and operates only with unframed data.

The DS1C signal is a 3.152 Mb/s serial, differential bit stream consisting of bipolar, return to zero (RZ) pulses. Data is coded with either alternate mark inversion (AMI) or bipolar eight zero substitution (B8ZS) coding. The DS2 signal is a 6.312 Mb/s serial, differential bit stream consisting of bipolar, RZ pulses. Data is coded using bipolar six zero substitution (B6ZS) or B8ZS line coding. These codes, respectively, replace strings of six or eight consecutive Spaces (zeros) with a six or eight digit code containing bipolar violations (BPV) that violate the AMI rule.

1.2 INTERFACE FEATURES

The DS1C/DS2 Data Interface has the following features.

- Performs standard bit and block error testing.
- Monitors "live" traffic. The FIREBERD can be bridged across a line to detect and count BPVs, and detects all ones or excess zeros.
- Can accommodate up to 24 dB of resistive attenuation.

1.3 INTERFACE COMPATIBILITY

The DS1C/DS2 Data Interface is designed in accordance with and meets the following interface standards.

- Bell System DSX-1C
- Bell System DSX-2
- CCITT G.703 for DS2-B8ZS

1.4 OPTIONS AND ACCESSORIES

The following cables are available from TTC for the DS1C/DS2 Data Interface (Model 30447A).

- Model 10420, 10' cable with WECO 310 plug to WECO 310 plug.
- Model 10558, 10' cable with WECO 310 plug to alligator clips.
- Model 10559, 10' cable with WECO 310 plug to bantam plug.
- Model 10599, 4' cable with WECO 310 plug to bantam plug.

INTERFACE DESCRIPTION

2.1 INTRODUCTION

The DS1C/DS2 Data Interface is a hardware-controlled interface. This section describes the interface physical dimensions, the interface function, internal jumper plug settings, timing sources, and the self-loop test.

2.2 PHYSICAL DESCRIPTION

The DS1C/DS2 Data Interface measures 7.3 inches (185 mm) wide, 1.5 inches (38 mm) high, and 5.1 inches (130 mm) deep. Two spring-tensioned screws secure the interface module to the FIREBERD Communications Analyzer rear panel. Connector pins on the interface module mate with the mainframe's connector receptacle when the interface panel is flush with the mainframe rear panel.

Four toggle switches provide the interface controls. Two connectors (BAL or UNBAL) provide the input (RX) and output (TX) connection to the interface. When testing DS1C or DS2 B6ZS signals, use the BAL (WECO 310) jacks. When testing DS2 B8ZS signals, use the BNC (UNBAL) connectors. Figure 2-1 illustrates the DS1C/DS2 Data Interface controls and connectors.

2.3 FUNCTIONAL DESCRIPTION

The DS1C/DS2 Data Interface is designed to meet the Bell System DSX-1C and DSX-2 specifications and the CCITT G.703 Recommendations. With this interface installed in a FIREBERD mainframe, the FIREBERD can be configured to terminate, bridge, or monitor a line. The INPUT toggle switch is set according to the testing being performed. This switch may be set to TERM, BRDG, or DSX-MON. Other interface switches are used to control the mode of operation, the timing selection, and the type of error detection.

With the INPUT toggle switch set to the TERM position, the interface impedance is determined by whether the BAL (WECO 310) jack is used or the UNBAL (BNC) connector is used. Using the WECO 310 jacks provide an interface impedance of 110 ohms, or by using the BNC connectors, an interface impedance of 75 ohms is provided.

2.3.1 Jumper Plug

Jumper plug JW1 is used to select either AMI or B8ZS coding during DS1C operation. This jumper plug is set for

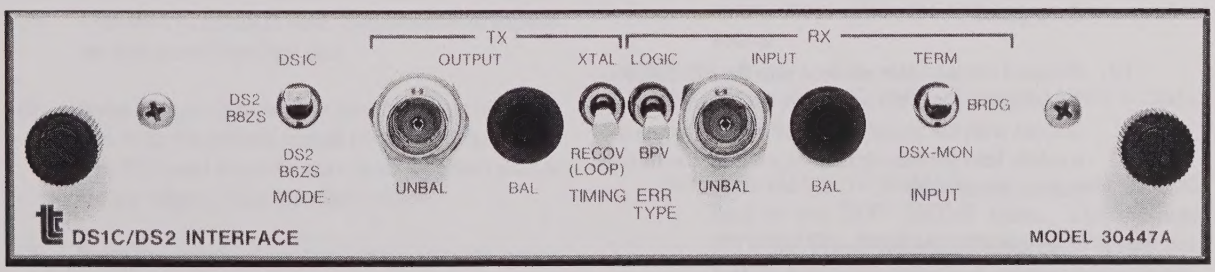

Figure 2-1
DS1C/DS2 Data Interface Controls and Connectors

AMI coding at the factory. To reconfigure this switch setting for B8ZS operation, perform the following steps.

(1) Turn the FIREBERD power off and remove the interface from the mainframe by rotating the two thumb screws counterclockwise until loose.

(2) Firmly grasp each thumb screw and gently rock the interface module sideways in the interface slot, while pulling gently on the interface.

(3) When the interface connector is free from the FIREBERD mainframe mating connector, slowly slide the interface module out of the interface slot.

(4) Set the interface module on a flat surface and remove the four Phillips head screws used to hold the black plastic cover to the bottom of the interface and remove the cover.

(5) Turn the interface module over and remove the two Phillips head screws, on the opposite side from the hinged standoffs, and slowly lift the top printed circuit (PC) board up.

(6) Locate JW1, on the component side of the PC board (30672). The jumper plug is located on the side opposite the hinged standoffs.

(7) Lift the jumper plug from the three-position header and move it one pin to the left (B8 position) and firmly press it back down again.

(8) Rotate the PC board back down and secure the PC board onto the standoffs with the two Phillips head screws.

(9) Reinstall the black plastic cover on the interface assembly with the four Phillips head screws. The smaller screws go into the holes near the interface front panel.

(10) Reinsert the interface module into the FIREBERD interface slot, until the back of the interface faceplate is flush with the mainframe rear panel. Secure the module into the mainframe by rotating the thumb screws clockwise.

(11) Turn the FIREBERD power on.

2.3.2 Timing Sources

Four clock timing sources are available: (1) the clock recovered by the interface from the received DS1C/DS2 signal; (2) the external BNC input, (3) the oscillator on the interface, or (4) the FIREBERD mainframe synthesizer. Selection of the timing source on the FIREBERD 6000 is made by pressing the front panel pushbutton switch labeled GEN CLK. Repeatedly pressing this pushbutton scrolls the through its three selections (SYNTH, INTF, or BNC). To use the clock recovered from the incoming DS1C/DS2 signal, GEN CLK must be set to INTF and the interface TIMING toggle switch must be set to the RECOV (down) position.

Selection of the timing source on the FIREBERD 4000 is made by pressing the CATEGORY rocker switch until the LED next to the GENERATOR CLOCK label is illuminated. The three pushbutton switches above the SETUP panel are used to select the desired timing source (INTRNL, INTF, or BNC). To use the clock recovered from the incoming DS1C/DS2 signal, GENERATOR CLOCK must be set to INTF and the interface TIMING toggle switch must be set to the RECOV (down) position.

2.3.3 Self-Loop

This data interface includes a relay that is activated by the SELF LOOP pushbutton switch on the FIREBERD front panel. Pressing the SELF LOOP pushbutton connects the transmit clock and data to the receive clock and data. This provides quick verification of the FIREBERD and the data interface. User connections do not need to be removed during the test, since complete isolation is provided by the relay when testing in the Self-Loop mode.

INTERFACE INSTALLATION AND SET-UP

3.1 INTRODUCTION

This section is divided into two major parts. Each part describes the installation, set-up, and operating procedures for the FIREBERD 6000 and FIREBERD 4000 mainframes, respectively. Refer to the appropriate FIREBERD mainframe User's Guide and Operating Manual for mainframe operating procedures and for additional information.

3.2 FIREBERD 6000

The following sections describe installation, set-up, and operation of this interface in a FIREBERD 6000 mainframe.

3.2.1 Interface Installation

The following procedure describes the steps for installing the interface in a FIREBERD 6000 mainframe.

CAUTION: Turn the AC power OFF before installing the interface module in the FIREBERD mainframe.

(1) Ensure that the POWER switch is in the OFF position on the FIREBERD mainframe front panel.

(2) Turn the FIREBERD mainframe around to expose the rear panel interface slot.

(3) Insert the interface module into the vacant interface slot, with the printed circuit (PC) board facing up. The PC board edges fit into slides on either side at the top edges of the interface slot.

(4) Press the interface module firmly into the mainframe mating connector, until the interface faceplate is flush with the mainframe rear panel.

(5) Secure the interface in the mainframe by turning the two interface front panel thumb screws clockwise, until finger tight.

3.2.2 FIREBERD 6000 Mainframe Set-Up

The following steps outline the procedure for setting up a FIREBERD 6000 mainframe after the interface installation is complete.

(1) With the DS1C/DS2 Data Interface installed, turn the AC power on by pressing the front panel POWER switch to the ON position.

(2) Connect the signal cable to the appropriate interface connector.

CAUTION: To prevent signal deterioration, use only one type of connector (BNC or WECO 310) at a time. Do not mix input and output connector types.

(3) Press the DATA pushbutton switch to select the desired data pattern. A data pattern is selected when the LED is illuminated next to the data pattern label. Refer to the FIREBERD 6000 User's Guide for a description of the different data patterns available and their uses.

(4) Press the GEN CLK pushbutton to select the signal timing source for use during the test. Selecting the BNC signal timing source requires an external clock source from either the network or from another source.

(5) Set the TIMING MODE as required for the test to be performed.

(6) Press the MENU pushbutton to illuminate the LED next to the INTF SETUP label. The message **INTERFACE: XXXXXX** is displayed on the top line and the available interfaces are displayed on the bottom line.

(6) Press the DS1C/2 softkey to select the DS1C/DS2 Data Interface. Pressing this softkey displays **INTERFACE: DS1C/2** on the top line.

(7) Set the interface controls as necessary (mode, timing, error type, and input) for the type of line to be tested. Section 3.2.3 describes these switches.

(8) Set the other front panel controls (ANALYSIS RESULTS, ANALYSIS MODE, PRINTER, etc.) as required for the test to be performed.

(9) Press the SELF LOOP pushbutton switch to perform the self-test on the mainframe and the installed interface.

3.2.3 Interface Set-Up

The DS1C/DS2 Data Interface is selected through the FIREBERD 6000 front panel controls and is controlled through the interface front panel switches. Once installed, the interface is enabled by pressing the MENU pushbutton switch until the LED labeled INTF SETUP (Interface Set-up) is illuminated. Observe the display above the softkeys to see the DS1C/DS2 Data Interface listed. Press the softkey directly below the displayed DS1C/2 listing. This enables the DS1C/DS2 Data Interface and back lights ALM1 and ALM2 located at the right of the FIREBERD front panel.

With the DS1C/DS2 Interface selected, the interface front panel toggle switches are used to control the interface operating parameters. The following paragraphs describe the switches and their settings.

MODE Switch - This three-position toggle switch is used to select the interface mode of operation. Setting this toggle switch to the up position selects the DS1C (3.152 Mb/s) operating mode. With this switch in the up position, the internal jumper plug is used to determine whether AMI or B8ZS coding is used. Refer to Section 2.3.1 to reconfigure the jumper plug. Setting this switch to the middle position selects the DS2 B8ZS (6.312 Mb/s) operating mode. Setting this switch to the down position selects the DS2 B6ZS (6.312 Mb/s) operating mode. In the DS1C or DS2 B6ZS modes, the TX output complies with the corresponding Bell System DSX pulse mask. In the DS2 B8ZS mode, the TX output complies with the CCITT Recommendation G.703 pulse mask.

TIMING Switch - This two-position toggle switch is used to select either the crystal oscillator (XTAL) or recovered clock (RECOV) as the transmit timing source when GEN CLK is set to INTF. Setting this toggle switch to the XTAL position allows the interface crystal oscillator to be the transmit timing source. Setting this switch to the RECOV (LOOP) position selects the recovered clock as the transmit timing source.

ERR TYPE Switch - This two-position toggle switch selects the type of error that is counted and analyzed by the FIREBERD. In the LOGIC position, only logic bit errors in the data are counted. In the BPV position, coding errors that are in the form of bipolar violations are counted. BPVs that are part of a B6ZS or B8ZS string are not counted. When operating in the BRDG (bridge) configuration, this switch should be set to the BPV position.

INPUT Switch - This three-position toggle switch is used to select the interface input impedance. In the TERM position, the impedance is 75 ohms for the BNC connector (UNBAL) and 110 ohms for the WECO 310 jack (BAL). In the BRDG position the impedance for both connector types is greater than 1000 ohms. In the MON position, the impedance for the BNC connector (UNBAL) is 75 ohms and the WECO 310 jack (BAL) is 110 ohms. The TERM position is used to terminate a line and the BRDG position is used when bridging a line. The MON position is used when the input signal has been resistively attenuated, up to 24 dB, like at a DSX monitor point.

When terminating a line, the FIREBERD mainframe transmits a test pattern to the system under test. The pattern is either looped back at some point or is received by another FIREBERD. The interface receive line (RX) is terminated by setting the INPUT toggle switch to the TERM position. Logic data errors can be analyzed or BPVs can be analyzed, depending on the setting of the ERROR TYPE toggle switch on the interface front panel. Pressing the ERROR INSERT pushbutton switch, located on the FIREBERD front panel, inserts a single logic error each time it is pressed. Pressing the ERROR INSERT pushbutton switch in until the LED within the pushbutton illuminates causes the FIREBERD to insert errors at the rate of one in 1000 bits (1 in 10^{-3}).

When bridging a line, setting the interface front panel INPUT switch to the BRDG position places a high impedance resistance across the INPUT (RX) connector. This allows non-disruptive monitoring of live data. It is recommended that the ERR TYPE toggle switch be set to the BPV position. This forces the interface to the recovered (RECOV) timing, regardless of the TIMING toggle switch setting. All ones and excess zero conditions in the received data will be detected.

When connecting the FIREBERD to a DSX monitor point, set the interface INPUT switch to the DSX-MON position. This allows non-disruptive monitoring of live traffic at a digital signal cross-connect (DSX) monitor point.

3.2.4 Interface Indicators

With the DS1C/DS2 Data Interface selected, the front panel labels ALM1 and ALM2 are backlit. These two indicators are used to indicate, respectively, all ones and excess zeros.

ALM1 - This LED illuminates when 1025 or more consecutive ones (Marks) are detected in the received data. This indicates a "blue alarm" condition or a "keep alive" signal on the line.

ALM2 - This LED illuminates when excess zeros are detected in the received signal. In DS1C mode, excess zeros is defined as 34 or more consecutive zeros for AMI coding, or 8 or more zeros for B8ZS coding. In DS2 mode, excess zeros is defined as 8 or more consecutive zeros for B8ZS or 6 or more zeros for B6ZS coding.

3.3 FIREBERD 4000

The following sections describe installation, set-up, and operation of this interface in a FIREBERD 4000 mainframe.

3.3.1 Interface Installation

The following procedure describes the steps for installing the interface in a FIREBERD 4000 mainframe.

CAUTION: Turn the AC power OFF before installing the interface module in the FIREBERD mainframe.

(1) Ensure that the POWER switch is in the OFF position on the FIREBERD mainframe rear panel.

(2) Turn the FIREBERD mainframe around to expose the rear panel interface slot(s). The FIREBERD 4000 may have two interface slots, if Option 4001 (optional interface) is installed. Slot 1 (the bottom slot) is standard and Slot 2 (the top slot) is optional.

(3) Insert the interface module into the vacant interface slot, with the printed circuit (PC) board facing up. The PC board edges fit into slides on either side at the top edges of the interface slot.

(4) Press the interface module firmly into the mainframe mating connector, until the interface faceplate is flush with the mainframe rear panel.

(5) Secure the interface in the mainframe by turning the two interface front panel thumb screws clockwise, until finger tight.

3.3.2 FIREBERD 4000 Mainframe Set-Up

The following steps outline the procedures for setting up a FIREBERD 4000 mainframe after the interface installation is complete.

(1) With the DS1C/DS2 Data Interface installed, turn the AC power on by pressing the rear panel POWER switch to the ON position.

(2) Connect the signal cable to the appropriate interface connector.

CAUTION: To prevent signal deterioration, use only one type of connector (BNC or WECO 310) at a time.

(3) Press the SETUP CATEGORY rocker switch to illuminate the LED next to the PATTERN label. This displays **PATTERN:** followed by the present data pattern. The first three data pattern choices are visible on the bottom line of the display. Pressing the MORE pushbutton switch displays additional data patterns. Pressing the corresponding softkey selects that data pattern for transmission and reception. Refer to the FIREBERD 4000 User's Guide for a description of the different data patterns available and their uses.

(4) Press the SETUP CATEGORY rocker switch to illuminate the LED next to the label GENERATOR CLOCK to select the signal timing source for use during the test.

(5) The front panel displays **GEN CLOCK: XXXXXX** on the top line and the three choices on the bottom line. Selecting the BNC signal timing source requires an external clock source from either the network or from another source.

(6) Press the SETUP CATEGORY rocker switch to illuminate the LED next to the INTERFACE label. The message **INTERFACE: XXXXXX** is displayed on the top line and a list of available interfaces is displayed on the bottom line.

(7) Press the DS1C/2 softkey to select the DS1C/DS2 Data Interface. Pressing this softkey displays **INTERFACE: DS1C/2** on the top line.

(8) Press the CATEGORY rocker switch to set or verify other criteria required for the test that is to be performed. Pressing the SETUP CATEGORY rocker switch to illuminate the LED next to the SETUP SUMMARY label displays the selected test pattern, interface, and clock frequency.

(9) Set the other front panel controls (RESULT SELECT, CATEGORY, PRINTER, etc.) as required to configure the mainframe for the test to be performed.

(10) Press the SELF LOOP pushbutton switch to perform the self-test on the mainframe and installed interface.

3.3.3 Interface Set-Up

The DS1C/DS2 Data Interface is selected by the FIREBERD 4000 front panel controls and controlled by the interface front panel switches. With the interface installed in a FIREBERD 4000 mainframe and the power turned on, press the SETUP CATEGORY rocker switch (either up or down) to illuminate the LED next to INTERFACE. This causes the installed interfaces to be displayed above the softkeys. If more than three interfaces are available, the MORE key illuminates. Press the softkey directly below the **DS1C/2** in the display to select the DS1C/DS2 Data Interface.

3.3.4 Interface Controls

With the DS1C/DS2 Interface selected, the interface front panel toggle switches are used to control the interface operating parameters. The following paragraphs describe the switches and their settings.

MODE Switch - This three-position toggle switch is used to select the mode of interface operation. Setting this toggle switch to the up position selects the DS1C (3.152 Mb/s) operating mode. With this switch in the up position, the internal jumper plug is used to determine whether AMI or B8ZS coding is used. Refer to Section 2.3.1 to reconfigure the jumper plug. Setting this switch to the middle position selects the DS2 B8ZS (6.312 Mb/s) operating mode. Setting this switch to the down position selects the DS2 B6ZS (6.312 Mb/s) operating mode. In the DS1C or DS2 B6ZS modes, the TX output complies with the corresponding Bell System DSX pulse mask. In the DS2 B8ZS mode, the TX output complies with the CCITT Recommendation G.703 pulse mask.

TIMING Switch - This two-position toggle switch is used to select either the crystal oscillator (XTAL) or recovered clock (RECOV) as the transmit timing source when the GEN CLK is set to INTF. Setting this toggle switch to the XTAL position allows the interface crystal oscillator to be the transmit timing source. Setting this switch to the RECOV (LOOP) position selects the recovered clock as the transmit timing source.

ERR TYPE Switch - This two-position toggle switch selects the type of error that is counted and analyzed by the FIREBERD. In the LOGIC position, only logic bit errors in the data are counted. In the BPV position, coding errors that are in the form of bipolar violations are counted. BPVs that are part of a B6ZS or B8ZS string are not counted. When operating in the BRDG (bridge) configuration, this switch should be set to the BPV position.

INPUT Switch - This three-position toggle switch is used to select the interface input impedance. In the TERM position, the impedance is 75 ohms for the BNC connector (UNBAL) and 110 ohms for the WECO 310 jack. In the BRDG position the impedance for both connector types is greater than 1000 ohms. In the MON position, the impedance for the BNC connector (UNBAL) is 75 ohms and the WECO 310 jack is 110 ohms. The TERM position is used to terminate a line and the BRDG position is used when bridging a line. The MON position is used when the input signal has been resistively attenuated, up to 24 dB, like at a DSX monitor point.

When terminating a line, the FIREBERD mainframe transmits a test pattern to the system under test. The pattern is either looped back at some point or is received by another FIREBERD. The interface receive line (RX) is terminated by setting the INPUT toggle switch to the TERM position. Logic data errors or BPVs can be analyzed, depending on the setting of the ERROR TYPE toggle switch on the interface front panel. Pressing the ERROR INSERT pushbutton switch, located on the FIREBERD front panel, inserts a single logic error each time it is pressed. Pressing the ERROR INSERT pushbutton switch in until the LED within the pushbutton illuminates causes the FIREBERD to insert errors at the rate of one in 1000 bits (1 in 10^{-3}).

When bridging a line, setting the interface front panel INPUT switch to the BRDG position places a high impedance resistance across the INPUT (RX) connector. This allows non-disruptive monitoring of live data. It is recommended that the ERR TYPE toggle switch be set to the BPV position. This forces the interface to the recovered (RECOV) timing, regardless of the TIMING toggle switch setting. All ones and excess zero conditions in the received data will be detected.

When connecting the FIREBERD to a DSX monitor point, set the interface INPUT switch to the DSX-MON position. This allows non-disruptive monitoring of live traffic at a digital signal cross-connect (DSX) monitor point.

3.3.5 Interface Indicators

With the DS1C/DS2 Data Interface selected, the front panel labels ALM1 and ALM2 are backlit. These two indicators are used to indicate, respectively, all ones and excess zeros.

ALM1 - This LED illuminates when 1025 or more consecutive ones (Marks) are detected in the received data. This indicates a "blue alarm" condition or a "keep alive" signal on the line.

ALM2 - This LED illuminates when excess zeros are detected in the received signal. In DS1C mode, excess zeros is defined as 34 or more consecutive zeros for AMI coding or 8 or more zeros for B8ZS coding. In DS2 mode, excess zeros is defined as 8 or more consecutive zeros for B8ZS, or 6 or more consecutive zeros for B6ZS.

INTERFACE SPECIFICATIONS

4.1 INTRODUCTION

This section contain the specifications for the DS1C/DS2 Data Interface. This information is listed in Table 4-1.

Table 4-1
DS1C/DS2 Data Interface Specifications

Item	Specification
Frequency Range	
DS1C	3152 kHz ±0.3 kHz (±95 ppm).
DS2	6312 kHz ±0.6 kHz (±95 ppm).
Input Level	
Pulse Amplitude:	
DS1C	±3V, ±0.3V.
DS2 (B6ZS)	±1V, typical.
DS2 (B8ZS)	±2V, typical.
Connectors	
WECO 310	Tip-ring-sleeve; with sleeve grounded and differential signal on tip and ring.
BNC	Tip-ring; ring is grounded and bipolar signal is on tip.
Input Impedance	
WECO 310	
TERM	110 ohms, ±10%.
MON	110 ohms, ±10%.
BRIDGE	Greater than 1000 ohms.
BNC	
TERM	75 ohms, ±5%.
MON	75 ohms, ±5%.
BRIDGE	Greater than 1000 ohms.

Table 4-1
DS1C/DS2 Data Interface Specifications (Continued)

Item	Specification
DS1C Output Signal[1]	
Pulse Amplitude:	±3V, ±0.3V.
Half-Amplitude Pulse Width:	159 ns, ±20 ns with a maximum imbalance of 9 ns.
Rise and Fall Times:	50 ns (20% to 80%) with 20 ns imbalance.
Trailing Edge Overshoot:	10% of pulse height.
DS2 B8ZS Output Signal	The DS2 B8ZS output complies with all specifications governing coaxial pair interfaces at 6312 kb/s, per CCITT Recommendation G.703.
DS2 B6ZS Output Signal	The DS2 B6ZS output complies with all specifications given for the DSX-2 interconnect in the AT&T Compatibility Bulletin No. 119, "Interconnection Specification for Digital Cross Connects".
Jitter Tolerance	For DS1C and DS2 operation, the receiver tolerates jitter that lies within the mask given in Figure 4-1 and Figure 4-2.
Crystal Oscillators	
Frequency	
DS1C:	3.152 MHz.
DS2:	6.312 MHz.
Accuracy and Stability:	±10 ppm. 0 to 50 degrees C.
Drift:	5 ppm/year typical.

[1]All specifications are for the output terminated into a 110-ohm resistive load.

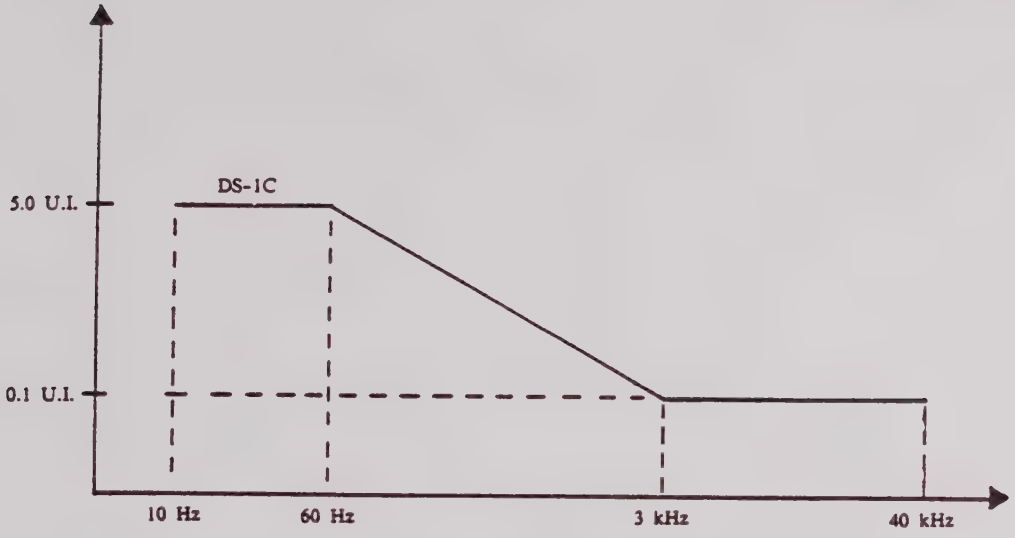

Figure 4-1
DS1C Jitter Tolerance

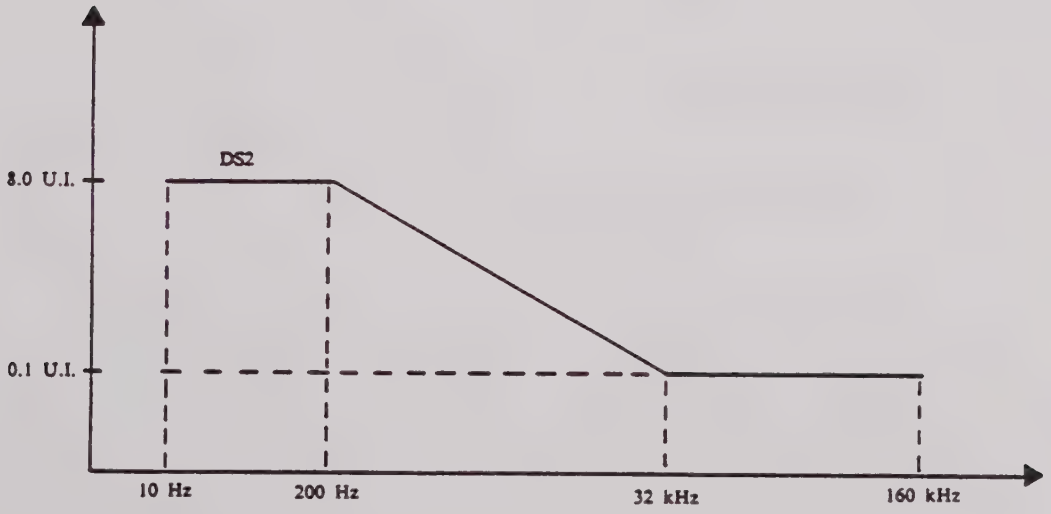

Figure 4-2
DS2 Jitter Tolerance

MAINTENANCE AND SERVICE

5.1 INTRODUCTION

This section contains information on maintenance and service for the DS1C/DS2 Data Interface, including TTC's warranty policies and repair procedures.

5.2 MAINTENANCE

5.2.1 In Case of Difficulty

If the mainframe totally fails to operate after installing the interface module, (i.e., no panel indicators light), check the following items:

- Verify that the supply line voltage is present.
- Verify that the AC line cord is supplying the line voltage to the mainframe.
- On the FIREBERD mainframe, verify the proper line voltage selection.
- On the FIREBERD mainframe, verify the fuse is not blown and that it is correct for the supplied line voltage.
- Verify the interface is properly seated into the mainframe.

If some of the indicators light but the unit fails to operate, verify that the interface installed is the correct type and that it is properly installed. Be sure to turn the power off before trying to remove or reseat the interface. If another interface module is available, turn off the power and substitute the other interface.

If troubles still persist, follow the self-test procedures in the FIREBERD Operating Manual as an aid in localizing the problem. If the mainframe continues to be inoperative, refer to the following sections for service information, or call the TTC Customer Service Department for assistance.

5.3 SERVICE

5.3.1 Warranty Policy

All equipment manufactured by Telecommunications Techniques Corporation (TTC) is warranted against defects in material and workmanship. This warranty applies only to the original purchaser and is non-transferable unless express written authorization of the warranty transfer is granted by TTC.

Data interfaces, accessories, cables, breakout boxes, and all equipment (other than FIREBERD mainframes) will be repaired or replaced (at our option), at no charge, for a period of one (1) year after shipment to the customer.

Liability under this warranty extends only to the replacement value of the equipment. This warranty is void if:

(1) Equipment has been altered or repaired without specific written authorization from TTC.

(2) Equipment is installed or operated other than in accordance with instructions contained in TTC literature and operating manuals.

No other warranty is expressed or implied. TTC is not liable for consequential damages.

5.3.2 In-Warranty Service

Equipment in warranty must be returned to the factory with shipping prepaid. The equipment should be packed and shipped in accordance with the instructions in Section 5.3.4 of this manual. Before returning any equipment, the customer must obtain a Return Authorization (RA) number by contacting the TTC Repair Department. The RA number should be included on all paperwork and be clearly marked on the outside of the shipping container.

After the equipment is repaired by TTC, it will be tested to applicable specifications, burned-in for at least 24 hours, retested, and returned to the customer with shipping prepaid.

A brief description of the work performed and the materials used will be provided on the Equipment Repair Report that will be furnished with the returned equipment.

5.3.3 Out-of-Warranty Service

The procedure for repairing out-of-warranty equipment is the same as that used for equipment still in warranty. However, there is a minimum charge applied to each request for out-of-warranty service. The minimum charge guarantees the customer an estimate of the repair costs and is used as credit against actual materials and labor costs should the equipment be repaired. Contact the TTC Repair Department for specific information on the minimum out-of-warranty repair charge.

The customer will be billed for parts and standard labor rates in effect at the time of repair. The customer will also be required to furnish a purchase order number before repair work can be started. A hard copy of the purchase order must be received by TTC before the repaired equipment can be shipped to the customer. A description of the materials used will be provided in the Equipment Repair Report.

Once an out-of-warranty repair is made, the repaired part or component is warranted for 90 days. This warranty applies only to the part or component that was repaired; other parts or components are not covered under the 90-day repair warranty.

5.3.4 Equipment Return Instructions

To all equipment returned for repair, the customer should attach a tag that includes the following information.

(1) Owner's name and address.

(2) A list of equipment being returned and the corresponding serial number(s).

(3) A detailed description of the problem or of the service requested.

(4) The name and telephone number of the person to contact regarding questions concerning the repair(s).

(5) The Return Authorization (RA) number.

If possible, the customer should return the equipment in the original shipping container and material. If the original container is not available, the unit should be carefully packaged so that it will not be damaged in transit. TTC is not liable for any damage that occurs during shipment. The customer should clearly mark the TTC-issued RA number on the outside of the package and ship it prepaid and insured to TTC.

TTC
Expect
Excellence

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